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Measurement of the Multiplicity and Energy Spectrum of γ-rays from the Thermal Neutron Capture Reaction Gd(n, γ)

Gadolinium (Gd) has the largest thermal neutron capture cross section among all stable nuclei. Gd has been used in liquid- scintillator neutrino detectors for neutron tagging. In this application, anti-electron neutrinos interacting on protons are identified by requiring both the prompt positron signal and the delayed gamma-ray signal from Gd neutron capture. Recently, a 200-ton Cherenkov detector (EGADS), loaded with 0.2% Gadolinium sulfate,
has been completed and started operation in the Kamioka Mine.
The neutron capture reaction is expected to produce 3-4 gamma-rays with total energy of 8MeV. However, how many gamma-rays are produced, how much energy they have, and how they are distributed spacially are not well known. We have conducted an experiment to measure the multiplicity and the energy spectum of gamma-rays using the JPARC pulsed neutron beam and a Germanium Spectrometer (ANNRI). We will present the new data and also show the comparison between data and the GEANT4 MC simulation, which is commonly used in the neutrino experiments. Our new data will improve the neutron tagging method and thus the anti-neutrino tagging method.

Primary author: Mr OU, Iwa (Okayama University)

Co-authors: Prof. KIMURA, Atsushi (Japan Atomic Energy Agency); Prof. HARADA, Hideo (Japan Atomic Energy Agency); Prof. SAKUDA, Makoto (Okayama University); Dr YANO, Takatomi (Okayama Univ.); Mr KAYANO, Tsubasa (Okayama University); Mr YAMADA, Yoshiyuki (Okayama University)

Presenter: Mr OU, Iwa (Okayama University)

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